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ABSTRACT

This study is intended to provide the methodology for a full-scale study which will develop a model of physician behavior in the practice of physical medicine, evaluate the adequacy of residency training in this field, and analyze the role of paramedical personnel in rehabilitation. Regular staff members of the Commission on Education in Physical Medicine and Rehabilitation recorded the activities of eight physiatrists for 4 months. Although acquainted with medical terminology, they were not familiar with the practice of physical medicine, and they avoided all unnecessary interference, so that their influence would not bias the data. The data classification techniques developed from the observations demonstrate the feasibility and desirability of a comprehensive study. (BH)

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FINAL REPORT

PILOT STUDY OF THE PRACTICE OF PHYSICAL MEDICINE AND REHABILITATION

(SRS Project No. RD-2742-M-69)

by Gary T. Athelstan, Karen C. Spensley, and Diane C. Tessari

For

The Commission on Education in Physical Medicine and Rehabilitation

The American Rehabilitation Foundation, Inc.
1800 Chicago Avenue
Minneapolis, Minnesota 55404

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FINAL REPORT

Pilot Study of the Practice of Physical Medicine and Rehabilitation

Gary T. Athelstan, Karen C. Spensley, and Diane C. Tessari

INTRODUCTION

The primary purpose of this pilot study was to prepare for a full-scale, comprehensive study of the practice of physical medicine and rehabilitation. Since the full-scale project is of a type which has seldom been done in medicine, and never in physical medicine and rehabilitation, the pilot work was aimed at developing the methods, instruments, and techniques required for later use in the comprehensive study.

Although some substantive findings regarding the practice of physical medicine and rehabilitation are reported here, they are based on very limited and not necessarily representative samples of physiatrists' work. Therefore, any statements in this report which describe physiatric practice, or which suggest conclusions about its nature must be regarded as preliminary and tentative. This study can be realistically evaluated only in terms of the contribution it has made to the methodological possibility of studying the practice of physical medicine and rehabilitation.

The objectives of the full-scale project would be:

1) To develop a detailed descriptive model of physician behaviors in the practice of physical medicine and rehabilitation.
2) To evaluate the adequacy of residency training in this field, in terms of its relevance to the demands of actual practice.
3) To obtain detailed data on patterns of utilization of paramedical personnel in rehabilitation, to determine which functions in rehabilitation require the unique training and skills of the physiatrist, and which may be delegated to other workers.

Examples of the discontinuities between training and practice with which the Commission is concerned may be cited as follows: (1) Previous Commission studies have revealed that over 50% of all certified physiatrists hold academic appointments and do some teaching in medical schools. Practically none have had any formal experience or preparation for teaching activities. (2) In the area of clinical practice, it is believed that leadership of the rehabilitation team is one of the critical functions that physiatrists serve. We are not

aware of any training programs that include group dynamics, team leadership, or any other topic appropriate to this function.

The Commission has also been long concerned with the critical shortage of qualified practitioners in the field of physical medicine and rehabilitation. This shortage, and the need for additional practitioners, has been well documented in previous Commission publications. A study of the ways in which physiatrists utilize their time would suggest means of making their practice more efficient. Previous studies suggest that physicians spend a great deal of time on functions that do not require their specialized training and skills. The planned full-scale study would identify such functions in rehabilitation, and analyses of the data and study of "natural experiments" already in progress would indicate ways of accomplishing these functions, alternative to requiring the direct intervention of the physiatrist.

In addition to examining procedural aspects of clinical practice, the full-scale study would also evaluate more general patterns of time utilization among physiatrists whose primary responsibilities are in teaching and administration. The Commission has found, for example, that academic physiatrists spend a reported average of only about 14% of their time teaching medical students. This figure, if found to be true in observations of academic physiatrists at work, suggests that much could be done to relieve the shortage of academicians in this field by finding ways of reducing the unessential, non-academic functions of those with primary teaching responsibilities.

The basic data needed to answer even relatively general questions about the practice of rehabilitation medicine are not available. More important for the purpose of this study, the methods for obtaining such data are in a very crude state of development. Professional or executive-level jobs have seldom been studied with objective techniques, and the limitations of such techniques quickly became evident to the Commission staff.

Among the more challenging methodological problems faced by the staff was that of obtaining useful data about needs for training. Direct observation, which appeared to be a very promising method for meeting the other study objectives, would not, by itself, reveal gaps in the training of physiatrists. It seems possible that the most critical training requirements are for rare behaviors, those which might not appear in even a very lengthy

series of observations, or for "judgmental" or other unobservable behaviors which would not be recorded by observation alone. However, the full-scale study would utilize not only direct observation, but also such techniques as self-report and work inventories. In addition, the data would be subjected to systematic evaluation by educators and practitioners of physical medicine and rehabilitation in order to make decisions about training requirements and possibilities for delegation of tasks.

METHOD

Since one of the principal aims of this pilot work was to develop recording forms to be used in gathering data on what physiatrists do, the necessary first step was to develop an outline of appropriate activity dimensions. This we did by direct observation. The instruments developed (exhibit 1) to record physiatrist behavior evolved from simple note-taking to systematic collection of data in categories developed by the observers. To avoid the bias of initially incorporating predetermined ideas about the practice of physiatry, no attempts were made before beginning the observations to identify even broad areas of physicians' responsibility. Additional measures were taken to avoid biasing the objective behavioral records. These included: 1) Using medically naive observers who would make few assumptions about what they were observing. 2) The observers viewed the same behaviors much of the time, but made their records and initially developed their categories independently of one another to provide checks on objectivity and inter-observer agreement or reliability.

Observers

The technique used in recording physiatrist activities was simply that of following the physician, observing and recording his activities during relatively large, continuous blocks of time. The observers (the junior authors of this report) were regular staff of the Commission on Education in Physical Medicine and Rehabilitation. As such, they were familiar with the principles, vocabulary, and some of the procedures of rehabilitation medicine, although they had had very little contact with physical medicine and rehabilitation in practice. They appeared to be about the age of medical students and were apparently so identified by many patients. They wore white lab coats and deliberately remained as unobtrusive as possible.

In a full-scale study, medical students on "free-term" fellowship programs could serve as very suitable observers, although the use of trained research personnel as observers would probably be preferable if it could be arranged. In the first place, satisfactory performance in the observer role appeared to depend more upon research skills than upon medical knowledge, thus eliminating any advantage that medical students or physicians might be presumed to have. Secondly, the use of non-medical observers avoids the possibility that a student-teacher relationship might develop between the observer and his subject, or that a subject physiatrist might feel that his performance is being "evaluated," instead of merely observed and recorded.

Before beginning actual observations, the observers attempted to familiarize themselves with staff names and positions and patient names and diagnoses, in order to be able to identify the occupations of staff, persons mentioned in conversation, or people speaking with physiatrists by telephone. It also appeared to be important to introduce the observers and their purpose to hospital staff, to avoid questions and introductions during observation periods. Before observing began, the observers also studied the forms and patient charts used, in order to be able to identify, from a distance if necessary, what sort of paperwork the physiatrist might engage in from time to time.

Our efforts to insure objectivity and to avoid interfering in any way with what was being observed appeared to be very successful. The patients and most clinical personnel seldom responded in any way to the presence of the observers. The subject physiatrists expressed some feelings of self-consciousness at first, but quickly became accustomed to their "shadows" and were not affected by the process. Observer questions and requests for interpretation were kept to an absolute minimum and were withheld until the end of an observation period. However, all of the subject physiatrists were very interested in the study and eager to cooperate, and several would occasionally volunteer explanations of procedures which they felt might be confusing to the observers.

Subjects

The subject physiatrists were chosen for the pilot study to represent the widest possible range of different settings and patterns of activities that could be observed within a reasonable distance of the Commission offices. Selecting the subjects in that way enabled us to develop a system and recording form that would encompass nearly all of the different physiatrist activities that might be observed in a full-scale study. Working together, the observers spent a total of 224 hours over about four months following eight different physiatrists. These physicians practice in a rehabilitation center, a university hospital, and a veterans administration hospital. Among them, two were primarily administrators, two were in children's rehabilitation, and one was in clinical research. Most of them were accompanied by residents and/or medical students part of the time they were observed. Exhibit 2 displays the observation time by setting. Of the total hours of observation time, 24 hours were spent testing and improving what is essentially the present coding system.

Recording System

The data were gathered and recorded, eventually in codes suitable for adaption to electronic data processing, but ar first, according to the following scheme: 1) the time a procedure or interaction begins; 2) basic category of activity observed, i.e., whether patient care, education, research, administration, or other; 3) action of the physiatrist, e.g., speaking, writing, observing; 4) subject of the activity, e.g., manual muscle testing, ADL's; 5) object of the activity, other persons or objects involved, e.g., patient, occupational therapists, equipment, paperwork.

The first day of observation in each setting typically included several instances in which the presence of a stranger affected the physiatrist's activities. He asked questions about the studies, offered suggestions, introduced the observer to people, or stopped to explain an activity or situation. The observers avoided initiating interactions with the physician, but did not try to discourage his interest, suggestions and explanations. Physiatrist's comments and explanations were extremely helpful to the project. Usually by the second day of being observed the physiatrist appeared to have little awareness of the observer.

Exhibit 3 gives an example of physiatrist activities as observed and recorded using the system developed. It is a sample of the notes taken early in the project, with codes added later. Both observers' codes are listed to illustrate the kinds of discrepancies that occurred between observers.

While we assessed inter-observer agreement, we did not attempt a statistical determination of inter-observer reliability for several reasons. Most importantly, the pace of the physiatrist's activities and the complexity of the recording system makes one-to-one matching of observers' codes meaningless. The level of agreement in such matching is almost entirely dependent upon the specificity of the records. Complete agreement between raters in all categories of behavior would suggest that the behavioral units being recorded were too gross to yield useful information. On the other hand, there were very obvious limits to the amount of detail that could be recorded. Recording systems with categories much "finer" than those we developed would be too complex to work with, even for well trained observers. A better assessment of reliability would be to summarize hours of data recorded by trained observers and compare their results.

A number of recording systems and devices were investigated. This process consumed a great deal of staff time, but it was considered necessary to solve the sizable mechanical problems involved in recording and transforming for analysis the enormous quantities of data gathered in such observational studies. The systems considered included a variety of streamlined recording forms, such as IBM Mark-Sense forms, etc., that are sometimes used in work measurement studies.

For a full-scale study of the practice of physical medicine and rehabilitation, our investigation suggested that the best results in gathering observational data could be obtained with a magnetic tape push-button coding system rather than with any paper and pencil system. A tape system has been developed for social interaction research at the University of Minnesota, and it was carefully investigated for its applicability to this study. The system (Minnesota Interaction Data Coding and Reduction System) is explained in some detail in exhibit 5. The advantages of this tape system are that observation time is recorded accurately and automatically, and that several middle steps in the process of putting data on cards or tape for analysis are eliminated.

In addition, the ease and speed with which events can be recorded make possible a considerable increase in the number of behavioral categories which can be used while still preserving an acceptable level of accuracy.

Although many of the pilot data were gathered by direct observation, it is likely that the principal data-gathering technique used in the full-scale study would be some form of self-report work inventory in which the physiatrists would record their own activities. The self-report task inventory approach has been used successfully in several studies of other rehabilitation professionals, most notably in research recently conducted by Dr. John Muthard at the University of Florida at Gainesville. The actual production of such an inventory for studying the work of physiatrists was beyond the scope of this pilot project, but the coding categories developed and the data gathered here provide nearly all of the activity categories and behavior descriptors that would be needed for a task inventory. The first step in the full-scale study would be to put such an inventory into written form and pre-test it with small samples of physiatrists, an effort that could now be accomplished very readily.

Development of the Recording Form

In the process of developing the recording form, the observers followed the rehabilitation center physiatrist for several days, taking copious notes. From these notes, the following variables could be identified:

1) Broad category of activity, e.g., direct and indirect patient care, education, administration, research, and other.
2) Name of event, e.g., ward rounds, progress (paper) rounds, gym rounds.
3) The observable behavior of the physiatrist, e.g., speaking, listening, reading.
4) The subject of the behavior, e.g., undergraduate medical education, patient's ability to follow instructions, physical therapy treatment program.
5) Patient involved (if any), disease category.
6) Other individuals, groups, or objects involved, e.g., nurse, team, equipment.
7) Time each activity or behavior begins (in order to determine time spent).

Between observation periods observers attempted to sort behaviors observed into categories. As expected, the number of categories grew as observation time increased. The range of categories in the system and the areas of emphasis also changed as different physiatrists' patterns of practice were added to the observers' experience. The rehabilitation center physiatrist, in addition to the usual patient care activities, supervised a resident, directed a major research project, was involved in preparation of educational materials and in courses at the center and at the university, and is a leader in community action programs related to health and rehabilitation. The set of categories first developed after observing this physiatrist had more research and community activity categories, and fewer different patient care and administration behaviors than were needed to account for the activities of the other physiatrists.

At the Veterans Administration Hospital the rehabilitation ward was full, and the physiatrist immediately responsible for the ward practiced without a resident. Consequently he spent more time in the care and treatment of patients. The third physiatrist observed directed the VA Hospital Physical Medicine and Rehabilitation Department and thus administered the therapy departments in addition to the patient care responsibilities he carried. He also had a part-time university teaching position.

By the time the observers began to record the activities of the university physiatrists, few categories were added or combined, but some adjustments were made in the coding system. For example, we resolved some of the complications that result from the combination of activities, such as when education and patient care or research and patient care take place simultaneously. At the university, the physiatrists observed were involved in education of residents, medical students, and paramedical personnel. Their responsibilities included didactic and clinical teach'ng, and such combinations of activities as educational administration, and research in education. One university physiatrist spent most of his time in clinical research. The department head is an administrator, educator, and writer, and is active in the professional organizations.

Initial attempts to construct a form were based on the names of the activities, such as progress rounds (team conferences),ward rounds, and gym rounds. This resulted in a set of five forms - four for patient care and one for other activities. These were extremely cumbersome, but did serve to test an initial set of categories.

At the same time that we were attempting to develop categories and coding forms by a series of "successive approximations," we also established more systematic ways of taking notes. These notes began to include codes that grew out of the activity categorization attempts. The final "form" represents essentially a refinement of the note taking system.

RESULTS

The final coding system included all but two of the seven variables identified initially. "Name of activity" and "patient characteristics" are not specifically included. Team conferences can be identified by the physiatrist's interaction with the team (TM). Patient characteristics can be listed in the observer's notes, and can be determined outside the observation period.

Some of the difficulties in categorizing behavior which we identified immediately were with 1) the fast pace of activities, 2) dual purpose activities, and 3) determining the purpose of the action.

The swift pace of a physiatrist's activities made recording difficult. The mean duration of physiatrists' activities at the level of specificity we were able to record was about four minutes. The modal length of recorded events was less than one minute. Even these brief activities usually contained several separate categories of behavior. Observers sometimes recorded eight or ten events per minute in a classification scheme designed to record behavior in categories fine enough to be useful in assessing residency training or patterns of utilization of paramedical personnel.

Frequently one activity serves two or more major functions. For example, when a resident participates in patient care, the physiatrist's activities fall into both the patient care (P) and education (E) categories. Under the present coding system, if the resident and patient are present the activity is coded "P" and "E".

Although always coded "E", there were many times when the resident's involvement in the physiatrist's activities did not appear to be for the purpose of education. The resident frequently acts as the physiatrist's assistant, doing the history and physical, and other general physician tasks. Physiatric residents are often certified in another specialty, and the residents we observed functioned much of the time as colleague and/or consultant. On the other hand, the physiatrist may explain a patient's treatment to a student,

an activity which might be performed solely for the purpose of education, and a patient's presence or patient care may be incidental.

A primary goal in the development of categories was to maintain an objective record of overt behavior. However, we did attempt to make judgements when an "educated guess" would add to, not detract from, or bias, data collected. We attempted to discriminate, for example, between situations in which the physiatrist was actually teaching, and those in which he observed or was assisted by a resident or medical student. Exhibit 3 shows examples marked with an asterisk (activity code 5 = teaching, 4 = discussing), of such dual-purpose behaviors for which coding conventions could be readily developed. For the full-scale study, of course, an explicit decision rule would be established to handle this and similar ambiguous coding situations.

Another situation in which the observers need to exercise some judgement is that of determining the purpose of parts of the patient evaluation examination. It is more meaningful for most of our study purposes to describe an activity as "manual muscle testing" or "test of flexion, extension" than to say "the physician moves the patient's arm".

A major complication in categorizing observed behavior that was not discovered immediately was that the two observers watching the same physiatrist were often not recording the same activities. In the continuous flow of conversation and activity there are seldom easily identified beginning and ending points. In fact, even the definition of an "event" is essentially arbitrary. A discussion with a nurse can touch on the condition, abilities and treatment of several patients in a minute or two. In such situations each observer might record up to eight or ten"items" a minute and find that only half of those matched items noted by the other observer. The two observers identified the same actions about 80% of the time, and agreed perfectly on codes for more than half of those items.

Disagreements noted in exhibit 3 illustrate some of those found in actual observation records, but did not occur in the same proportions. In the observation period, more than 2/3 of the disagreements were confined to the "subject of the activity" codes (10-99). Many of the inter-observer disagreements in both the coded notes and actual observation record could be eliminated by establishing a convention for certain easily identified behaviors (marked "CONV" on exhibit 3) or by making use of the summary categories 10, 20, 30, 40 (marked "SUM" on exhibit 3).

The disagreements of more substance are among the full sets of evaluation and treatment categories (marked "E-E" or "E-T" on exhibit 3). A brief conversation could include discussion of muscle weakness (P23) responsible for disability to perform a task (P33), so that patient should get OT exercise or activity (P43). Each observer may record a different one of these codes to represent the most prominent point of the discussion. The most common disagreement in observation was between 34 and 44, mental/emotional ability and treatment. As is evident in the assignment of corresponding numerical codes, we recognized some natural configurations of condition, abilities and treatment. While two observers may disagree whether an exchange was essentially around evaluation or treatment, their codes will identify whether it was related to speech, emotion, or to the broad interwoven set of categories concerned with musculo-skeletal physical conditions, abilities, and treatment.

As mentioned previously, statistical reliability of categorization of observed behavior, i.e., matching codes to determine what percent of the time observers agree, is largely a function of the "fineness" of the categories. A fairly high reliability figure could be cited for observations using only the "basic purpose", "physiatrist activity", and "other person" categories. The fineness of the categories could, of course, be adjusted to serve various data collection purposes. While the "subject of the activity" categories, for example, are more difficult to discriminate, and therefore less reliable, they are among the few that are relevant to an educational evaluation purpose, and they should presumably be retained.

SUMMARY AND SUGGESTIONS FOR FURTHER RESEARCH

The results of the pilot study clearly demonstrate both the feasibility and the desirability of a full-scale study of the practice of physical medicine and rehabilitation. The findings are summarized below as they relate to each of the objectives of the full-scale project, respectively:

1) To develop a detailed descriptive model of physician behaviors in the practice of physical medicine and rehabilitation.

The observation recording system designed in this Pilot Study could be used in the full-scale study to produce a descriptive model of physiatrist activities. Such a model would provide information such as the number of hours or percent of time spent giving general physical examinations, measuring range of motion, administering EMG's, or performing other specific activities.

This type of record could, among other things, permit the identification of "routine," i.e., repetitious or frequently-performed behaviors, which would be a reasonable first step in the objective isolation of potentially delegatable activities.

Exhibit 4 displays a breakdown of physiatrist activities in much more general terms. Broad categories of activities like these could be extracted from behavioral records produced with this system, by selecting certain codes. For example, time spent in activity 4 (patient care paper work of exhibit 4) could be compiled by adding all the time spent in basic activity category "P" (patient care) with the object PW (paper work) or FI (patient charts and files).

In the course of the pilot work, several systems for recording and analyzing observational data were investigated. The most promising of these, and the one strongly recommended as an adjunct to the task inventory for a full-scale study, was the Minnesota Interaction Data Coding and Reduction System. This system is described in detail in Exhibit 5.

The data to be gathered in the full-scale study would be obtained by a combination of methods, most importantly by some form of self-report task inventory. The basis for developing a physiatrists' task inventory is provided by the findings of this pilot work. Actually producing such an inventory would be one of the first steps of the full-scale study.

2) To evaluate the adequacy of residency training in this field, in terms of its relevance to the demands of actual practice.

This objective may prove to be the most difficult to achieve of those originally stated for the full-scale study. As was previously mentioned, relating the observed behaviors of practicing physiatrists to the content of their training programs does not directly reveal discontinuities between training and the demands of practice. Such gaps can only be identified by supplementing a training-to-practice matching analysis with a very thorough evaluation of all the data by experts in the field. However, the Commission expects to be able to resolve most of the difficulties in this phase of the full-scale study through appropriate and extensive use of the substantial resources for research that it has developed. The Commission possesses considerable detailed data on the content of residency training, which have been gathered in its studies of these programs. In addition, the Commission members and their consultants are

leading authorities in education and practice in rehabilitation medicine, and their judgments, systematically gathered and analyzed will provide an important means of evaluating training in this field.

3) To obtain detailed data on patterns of utilization of paramedical personnel in rehabilitation, to determine which functions in rehabilitation require the unique training and skills of the physiatrist, and which may be delegated to other workers.

As with the second objective above, this goal must also be partly achieved through the use of expert judgment. Although this process is partly subjective, it is possible, as previously implied, to largely objectify the judgments and make them reliable. Objectivity is achieved by using a "concensus of expert judgment" procedure in which individual opinions or options are assigned numerical values, and the pooled judgments of experts are statistically analyzed to make an arithmetic decision. This method could be very useful in making judgments about delegating responsibility to lesser trained workers, and it would also constitute the principal technique for the evaluation of the training programs.

The findings of the pilot study naturally did not confirm all the expectations of the Commission. For example, the methodological problems inherent in a study of this sort seemed sufficiently challenging in the abstract. In reality, these problems seemed at times to be impossibly complex. However, the Commission is now, more than ever, convinced of the need for such a study, and confident that it will help to solve some of the pressing problems in rehabilitation medicine. Some of the substantive findings of the study suggest new and additional issues which will be dealt with in the full-scale study.

Although not enough physiatrist time was recorded in this study for statements describing physiatrists' practices to be considered reliable or significant, it is interesting to note the differences, as shown in exhibit 4. The clinical physiatrist spent more than twice as much time with patients as the physician responsible for department administration. The physicians with residents and medical students spent 49% of their time accompanied by a student, 12% of their time teaching. However, they spent 16% less time in paper work and miscellaneous detail than the VA clinical physician who practiced without a resident. While these differences are probably not statistically significant they confirm the impressions of the observers that the

resident acts as a physiatrist assistant, relieving him of many clerical duties. The observers noted that the physiatrist practicing without a resident performed many general physician duties while those with residents delegated the routine history and physical, and seemed to do little that would not be considered part of the specialty of physical medicine and rehabilitation.

Since the pilot work was begun, the Commission has developed a considerable interest in the possibility of training and using physician assistants in the field of physical medicine and rehabilitation. Although more data are obviously needed to evaluate the substantive findings of this pilot study, the observers did record some distinct impressions relevant to the use of physician assistants in this field: 1) Physiatrists already make very heavy use of paramedical personnel, especially in clinical care; some physiatrists seem to make such good use of clinical assistants that they intervene in patient care only when the exclusive skills of a physician are required. Their clinical capabilities could scarcely be further augmented by clinical assistants. 2) Some physiatrists seem to spend a significant amount of time in non-clinical activities, primarily of a medical administration nature. Their clinical capabilities could probably be considerably augmented through the use of a "rehabilitation coordinator" - type of assistant. In addition, of course, most physiatrists could presumably extend their effectiveness by using assistants who were properly trained to substitute for them in certain defined areas of medical and non-medical responsibility.

At any rate, there is little doubt that a comprehensive study of the practice of physical medicine and rehabilitation would provide information of great value in answering a number of crucial questions confronting the field today. The present study, of course, does not begin to directly answer any of those questions, but by demonstrating the feasibility of a full-scale study, and by resolving some of the major methodological problems that would be encountered in such a study, this pilot project can contribute significantly to progress in the practice of physical medicine and rehabilitation. The staff and the members of the Commission on Education in Physical Medicine and Rehabilitation recommend strongly that a full-scale study be undertaken.

EXHIBIT I: Coding Categories

BASIC PURPOSE CATEGORIES

Up to 2 may be used. Put primary code in column 2. Column 1 may be blank.

P = patient care, management (i.e., care of a specific patient)
E = education
R = research
A = administration
Ø = other, unidentified

For example, "resident watches physiatrist test patient's ability to follow instructions" would be coded:

col.	1	2	3	4-5	6-7	8-9
	E	P	1	34	PA	RE

Basic code for incident is in col. 2.

Additional code for resident education is in col. 1.

For another example, "physiatrist watches resident test patient's gait" would be coded:

col.	1	2	3	4-5	6-7	8-9
	P	E	8	32	RE	PA

PHYSIATRIST ACTIVITY CATEGORIES

Only one may be used. Column 3.

1 = examines, administers diagnostic test (20's) or treatment (40's). Usually non-verbal, except to ask patient to demonstrate abilities (30's)

2 = orders or suggests treatment procedures, prescribes (may be verbal or written)

3 = makes arrangements, schedules something (may be verbal or written)

4 = verbal exchange, discussion, inquiry, participates in meeting, team conference

5 = teaches, demonstrates, explains to student, lectures

6 = writes other than orders and arrangements, letters, reports, progress notes (includes dictation for charts)

7 = reads, scans x-rays, looks at chart

8 = observes, attends, listens to report, watches someone else work with patient or test patient's abilities (i.e., takes more passive role)

9 = other, unidentified

0 = non-business or nothing accomplished time, personal, travel, looking for patient or staff member, waiting

(Continued on next page)

EXHIBIT I: Coding Categories (Continued)

OBJECT OF THE ACTIVITY CATEGORIES

Only one may be used. Columns 4-5.

Object categories 10, 20, 30 and 40 are designed to be summary categories. For example, a 30-second progress report including patient's condition (20's), and treatment (40's), and/or prognosis (17) could be coded, or later summarized, 10.

A brief conversation that touches several aspects of patient condition can be summarized 20; several functional abilities, 30; and more than one kind of treatment, 40.

Object codes 50-59 should be used when it is not possible to use more specific codes. For example, "physiatrist and resident discuss patient's medication" (EP441RE) vs., "physiatrist and resident set up resident's schedule" (E354RE) or "physiatrist discusses journal article with resident" (E454RE). The latter would be coded E554RE if the physiatrist were quizzing the resident or explaining something to him.

10 = vague, general patient progress, evaluation, treatment, summary; or several patient care items listed below occur in a few seconds; "How are you?", "How is Mr. C.?"

11 = usual physical exam--EENT, heart, lung, etc.
12 = medical history
13 = vocational, educ., social, family history, situation
14 = medical problems other than PM&R (e.g.,a cold, a fall)
15 = non-medical prolems (e.g., finances)
16 = discusses a disease, rather than patient (e.g., MS, CP)
17 = prognosis, expectations for patient (not treatment-40's)
19 = other patient care not above or below (specify in notes)

20 = evaluation: condition, progress; more than 1 of 21-29
21 = electrodiagnosis: EMG, EKG, etc.
22 = range of motion, limitation of flexion, extention
23 = muscles: manual muscle testing, muscle strength
24 = assessment of conformation (e.g., scoliosis)
25 = lab tests, x-rays, etc. (generally internal condition)
26 = assessment of skin condition
27 = painful area, pain, swelling: palp., visual assessment
28 = other tests of neuromusculoskeletal: sensatn, spast'y
29 = other eval physical condition (specify in notes)

30 = evaluation: functional abilities, more than 1 of 31-39
31 = vision, field
32 = ambulation, balance, kinesthetic, lower extremities
33 = upper extrem abilities, activities
34 = mental/emot abilities, attitude, abil follow instr.
35 = speech, ability to communicate
36 = internal functions; cardiac res., pulm., vasc. function
38 = ADL's, self care, bowel, bladder independence
39 = other eval of abilities, disabilities (specify in notes)

(Continued on next page)

EXHIBIT I: Coding Categories (Continued)

OBJECT OF THE ACTIVITY CATEGORIES (Continued)

40 = patient managm't: goals, treatm't, referrals, sum 41-49
41 = medication
42 = PT modalities: manipulat'n, massage, ht., lt., exer.
43 = OT activities, treatment
44 = psych aspects of treatment; behavior modification
45 = speech therapy, teach communicative skills
46 = orthotic, prosthetic equipm't, braces, other equip
47 = nursing procedures not otherwise listed: posit'ng, etc.
48 = discharge arr., post discharge therapy, equip etc.
49 = other treatment procedures (specify in notes)

50 = administ'n of PM&R dept, therapy depts, own sched
51 = other administration, hospital administration
52 = undergraduate medical education
53 = self-education
54 = resident education
55 = other education, parameds ed.
56 = community health activities (e.g. Heart Assoc.)
57 = clinical research or its reports, articles
58 = other research, e.g., in systems
59 = other non patient-care activities

98 = personal time: lunch, coffee (not chatting w/personnel)
99 = miscellaneous trivia: "Good morning", waiting
00 = unidentified

(Continued on next page)

EXHIBIT I: Coding Categories (Continued)

OTHER PERSONS, OBJECTS INVOLVED

Up to 2 may be used, in order of primacy.
Columns 6-7, 8-9.

PA = patient
PF = patient and family together
FM = family of patient
MD = another physician
NU = nurse, RN, LPN
NA = nurse's aide
OY = orderly
PT = physical therapist, PT aide
OT = occupational therapist, ass't
CT = corrective therapist
ET = educational therapist
TX = other therapist
SP = speech pathologist, audiologist
PS = psychologist
SW = social worker
LM = limb-maker, prosthetist, orthotist
HA = hospital administrator
ED = educator
SY = secretary, clerk
RE = resident
MS = medical student
OS = other student
TM = team, more than two team members
CS = class
MG = other group
EQ = equipment
FI = patient charts, files, forms
PW = other paperwork
99 = other
00 = unidentified

EXHIBIT 2: Observation Time By Setting

Setting	Number of physicians observed	Total hours of observation
Rehabilitation Center	1	60 1/2 hours
Veterans Administration Hospital	2	105 3/4 hours
University Adult Rehabilitation Center	3	35 3/4 hours
University Childrens' Rehabilitation Center	2	21 3/4 hours
		223 3/4 hours

EXHIBIT 3: Sample "Raw" Observational Record[1]

UNIVERSITY, MD[3]

Time	Interaction With What or Whom	Object of Interaction	Observer 1	Observer 2	Discrepancy[2]
9:20	Secy	Misc. - gives her questionnaire	Ø300SY	A330SY	
	Med student on internship	Discusses w/him what they'll be doing for week (he's on 1 wk. surgical subspecialty rotation). Explains booklet, shows him PM&R textbook, recommends it, discusses his schedule w/him.	E452MS	E352MS E552MS	CONV*
9:25	Med student on internship	Discusses his schedule w/him			
	Secy	Asks her to check on something in connection with student's schedule	E352SY	E352SY	
		Back to student	E452MS	E452MS	
9:30	Med Student	Asks him what he's going into - discusses it with him Asks if he's seen any chronically ill PA's lately	E416MS	E552MS	CONV*
9:35	Med student	Asks what services he's been on and continues along lines of what chronically ill PA's were seen	E452MS		
	Med student	Dr. makes notes on blackboard as student describes a pa. he had seen	E410MS		
9:40	Med student	Questions student on how he took history on above PA - takes notes on blackboard	E412MS	E512MS	CONV*

[1]Some of the codes used here may not precisely match the final coding scheme since some changes were made in the coding categories after this protocol was obtained.

[2]Classification of coding discrepancies is as follows:
CONV = a coding convention should be established
SUM = items could be summarized, or differences due to one observer summarizing
E-E = difference is between the two evaluation category sets
E-T = difference is between evaluation and treatment categories

* These are examples of cases in which a discrimination was attempted between what is actually teaching (activity code 5) and what is just discussion (activity code 4) occurring as the student or resident assists or accompanies the physiatrist.

(Continued on next page)

EXHIBIT 3: Sample "Raw" Observational Record (Continued)

UNIVERSITY, MD_3

Time	Interaction With What or Whom	Object of Interaction	Observer 1	Observer 2	Discrepancy
9:45	Med student	PA is set up now as example - continue discussing him - outcome	E410MS	E510MS	CONV*
9:50	Med student	Continues discussion on above PA from chronic illness viewpoint	E416MS	E516MS	CONV*
		Tells him about history-taking w/PA w/chronic disease. There is a difference	E412MS	E512MS	CONV*

VA HOSPITAL, MD_2

Time	Interaction With What or Whom	Object of Interaction	Observer 1	Observer 2	Discrepancy
10:25	RN	Social Conversation	Ø999NU	P499NU	CONV
	PA	Examines leg, verbally notes condition, asks about exercises	P120PA P442PA	P128PA P442PA	SUM
	PT aide	Ask him about above PA's arterial circulation	P438PT	P438PT	
		Also about treatment for PA	P442PT	P442PT	
10:30	Prescription on consult sheet	Writes prescription for PA (revises treatment) Hubbard tank exercises	P242FI	P242FI	
	PT aide	Gives him prescription and instructions	P242PT	P242PT	
	PA	Examines stump (left BK)	P120PA	P128PA	SUM
	PT	Social	Ø999PT	P499PT	CONV
	RN	Social	Ø999NU	P499NU	CONV
	Secy 2	Gives her consult	P310FISY	P310FISY	
10:35	Telephone to another MD	About his exam of PA the other Dr. has now - to check agreement	P410MD	P420MD	SUM

* These are examples of cases in which a discrimination was attempted between what is actually teaching (activity code 5) and what is just discussion (activity code 4) occurring as the student or resident assists or accompanies the physiatrist.

(Continued on next page)

EXHIBIT 3: Sample "Raw" Observational Record (Continued)

VA HOSPITAL, MD_2

Time	Interaction With What or Whom	Object of Interaction	Observer 1	Observer 2	Discrepancy
	Secy I	Asks her name of OT student	E455SY	E455SY	
10:40	Still on phone	Also talks about OT student	E455MD	E455MD	
10:43	(M.D.)	and about other MD's having	E400MD	E455MD	
		been on TV and changes in	E452MD	E452MD	
		curriculum for MD's			
10:45	Consult sheets	Reads over one	P710FI	P710FI	
	Phone to CT	Asks if PA is there	P099CT	P099CT	
	Consult	Looks at another	P710FI	P710FI	
	Oscillometric test report	Looks over - evaluates circulation - writes it on report	P725FI	P725FI	
10:48		(Tells us about PA - ulcer on BK stump)			
		Writes report on above PA Puts in OUT box	P610FI	P610FI	
	Mail	Looks it over	Ø759MA	A700MA	
	Secy I	About request for evaluation of PA	P240SY	P410SY	
		Finds PA's room # on directory	P319SY	P399PW	CONV
	Secy	Asks what room a PA's in	P319SY	P399SY	CONV
	PA (Stroke)	Examines rt. arm for contractures in fingers, hip, knees - finds contractures, ulcer, spasticity	P122PA P126PA P124PA	P120PA	SUM
11:00	Consult Sheet	Writes report on PA	P610FI	P610FI	
11:05	PA directory	Looks for PA	P31999	P399PW	CONV
	RN	Tells him where he is	P319NU	P399NU	CONV
11:09	PA	Talks to him about operation	P449PA	P412PA	
		Examines leg - tests for function	P132PA	P128PA P132PA	
	Consult sheet	Writes report	P632FI	P610FI	
		Continues exam of function of feet	P123PA	P132PA	E-E

(Continued on next page)

EXHIBIT 3: Sample "Raw" Observational Record (Continued)

VA HOSPITAL, MD_2

Time	Interaction With What or Whom	Object of Interaction	Observer 1	Observer 2	Discrepancy
		Weak ant. tibs.			
		Writes more	P623F1	P623F1	
11:15	Stop to watch	inauguration	Ø99899	Ø898MG	CONV
11:28	Teacher	Social	Ø998ET		
11:39	Consult sheet	Puts in OUT basket	P31099	P310F1	
	Consult sheet	Writes report on foot drop prob.	P631F1	P620F1	E-E
11:35		Continues to write report			
		Writes Rx for PA	P200F1	P240F1	
	Consult sheet	On PA with foot drop. Reads sheet. Writes note to have Dr. see him after he sees this PA	P610F1 P340PW	P210F1	
11:38	Request for material for recreation therapy section	Reads over,order, concurs, countersigns	A650PW	A350PW	
11:40	Secy 2	Leaves paper on her desk	A350PWSY	A399PW	
	Oscil. test report	He checks it, OK's it (secy had typed it)	P725F1	P725F1	

EXHIBIT 4: Summary Analysis of Several Observational Records

Activity	Percent of time spent on activity during observation periods. VA M.D.[1] (clinical responsibility)	VA M.D.[2] (administrative responsibility)	University[1] (clinical/ education)
Patient care related to a specific patient.			
1. Patient contact: tests, treatment, examination, conversation with patient	32%	13%	32%
1.1 Patient and team member			(4%)[2]
2. Team consultation: conversation, requests, orders, suggestions to rehab staff	27%	14%	25%
2.1 formal meetings, e.g., paper rounds	(21%)	(10%)	(10%)
3. Consultation and exchange of information other than team: consultation with referring physician, family, other; includes letters of inquiry or explanation.	3%	1%	1%
4. Patient care paperwork: charts, forms, treatment orders, consultation forms; includes discussion of how to fill out forms	20%	12%	9%
5. Patient care-other of substance: physician preparation for test or treatment, adjustment of equipment, viewing x-rays	6%	2%	4%
5A. Patient care-other, miscellaneous details: travel from patient to patient, wash between patients, ask whereabouts of patient	4%	9%	1%
6. Administration of patient care departments: patient schedules, recruitment for therapy dept., department policies.	1%	9%	1%
6.1 paperwork: purchase orders, relevant mail	(0%)	(2%)	

[1]Combined observation time of two physiatrists in the same setting--Childrens' Rehabilitation Center.

[2]Percentages in parentheses represent activities which are included also in the immediately preceeding category.

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EXHIBIT 4: Summary Analysis of Several Observational Records (Continued)

Activity	Percent of time spent on activity during observation periods. VA M.D.1 (clinical responsibility)	VA M.D.2 (administrative responsibility)	University (clinical/ education)
Activities other than patient care.			
6A. Hospital administration: managers meeting, recruitment for physiatrist, hospital bulletins	.2%	11%	
7. Education-on-site which is not combined with other activities (see 7A. below)			12%
8. Education - classroom: travel, arrangements, preparation, delivery, conversation	0%	12%	
8.1 preparation	(0%)	(5%)	
8.2 delivery of lecture	(0%)	(3%)	
9. Self-Education - journals, films, in-service training, discussion with staff re new methods, etc.	3%	16%	4%
10. Research	3%	.2%	11%
7A. Education-on-site (these categories overlap with each other and with other categories, particularly patient care, 1 to 6 above)			49%
7A.1 resident			44%
7A.1.0 resident present, observing			(16%)
7A.1.1 teaching resident, adm. res. ed.)			(15%)
7A.1.2 resident leads, presents case			(13%)
7A.2 medical student			22%
7A.2.0 medical (student present, observing)			(8%)
7A.2.1 teaching med. student			(12%)
7A.2.2 med. student leads, presents case			(1%)

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I.

EXHIBIT 5:

The Minnesota Interaction Data Coding and Reduction System (MIDCARS)

(Adapted from "...An Appraisal..." by Richard E. Sykes)

Observational research, whether in the laboratory or in the field, has always been laborious because of the immensity of data coding and reduction problems. During the summer of 1967 Richard E. Sykes and Fraine E. Whitney surveyed the available instrumentation, investigating particularly event recorders, the interaction chronograph, and any other equipment which came to their attention. All available instrumentation appeared to have one or more shortcomings. Either it was not portable, had too few possible interaction codes, or required extensive data reduction labor. They felt that adequate instrumentation must possess the following characteristics: (1) It must be portable. (2) It must be capable of use by people with relatively average academic training and physical coordination. (3) It must have the potential of enough codes for relatively complex coding systems. (4) It must provide a record of accurate timing of events. (5) The data must be reducible almost automatically to the computer. After consultation with a number of persons on the state of the art of electrical engineering and computer technology, Messrs. Sykes and Whitney invented the Minnesota Data Coding Reduction System. Upon consultation with the Graduate School of the University of Minnesota it agreed to provide the funds for reducing the invention to practice, and bids were sought from several firms. The bid of Electro/General Corporation of Hopkins, Minnesota was accepted and construction began. The first encoders were delivered in late December 1967. The translator was delivered about March 1, 1968.

The development of MIDCARS has gone through two technical stages. In the first stage tones were used in a "parallel entry" data recording system in which the frequencies representing the selected codes were recorded on the analogue tape. This required a tape recorder sensitive to different frequencies and exact in terms of the speed and pressure of the tape passing the recording heads. Because of the inadequacy of commercial tape recorders in the lower price range in meeting these conditions, the original system was modified for serial entry, thus overcoming the deficiencies of the recorders. The pilot system we are now using utilizes the principle of frequency shift keying (FSK). The modification

EXHIBIT 5:

The Minnesota Interaction Data Coding and Reduction System (MIDCARS) (Cont'd)

to FSK was completed in the middle of the summer of 1968. This second system has been tested, and has proved very dependable. To date about 194 hours of field observations using the tone code system, and over 100 hours of observations using the FSK system have been completed. In both cases the coding categories number about twenty-five with a few additional "bookkeeping codes." The MIDCARS system has a potential of thirty-one different codes, with a good many more possible if permutations of the original thirty-one are added. The number of codes possible is limited more by the capacity of the observer than by the instrumentation itself.

THE INSTRUMENTATION

For encoding the observer carries, hung around his neck, an ordinary commercial Norelco portable cassette tape recorder in a leatherette case. In the same case is an encoder which produces electronic signals. The portable tape recorder is modified not only so as to receive signals, but also so that the permanent batteries in the recorder can be recharged through a battery charger which plugs into the wall and which is built into the bottom of the recorder case. The whole device weighs about four-and-one-half pounds.

Plugged into the encoder is a hand unit at the end of a thirty-inch cable. In the hand unit are five switches (buttons) which correspond with the five digits of the left hand. These five buttons may be simultaneously pushed in any one of thirty-one different combinations. Each combination signifies a certain code. The unique signal produced by any particular combination of buttons is recorded on the tape cassette in the portable tape recorder (this tape is hereafter referred to as the analogue tape). Simultaneously real time information is also recorded utilizing a clock pulse generator located in the encoder.

When the tape recording of signals made during the observation is returned to the office the tape is played through the translator. The decoder not only includes the decoding electronics, but also a set of thumb wheels for entering data by hand, and an incremental digital tape recorder which produces a tape compatible with the University of Minnesota's CDC 6600 computer. To save time in playthrough the tape speed is twice that of the original recording so that, for instance, an observation

EXHIBIT 5:

The Minnesota Interaction Data Coding and Reduction System (MIDCARS) (Cont'd)

of one hour is translated in thirty minutes. As each FSK code signal passes through the decoding electronics it is transformed into a binary equivalent on the computer tape, and after each such signal and a second binary number from the clock signal registers on the computer tape which corresponds with the real time in seconds from the time the observation began to the time when that particular signal occurred. Thus a record is made on the computer tape which permits computation not only of the frequency of signals, but the duration of particular events. It will be noted that the real time in the analogue tape is transformed into a record of time. Before each analogue tape is played through the translator the six thumb wheels are utilized to enter on the computer tape by hand information identifying the particular analogue tape (observation). The translator is simple to operate and an operator can be trained in a few minutes. After a series of analogue tapes have been translated onto the computer tape, the computer tape (transient tape) is taken off the translator and sent to the computer center.

When the tape is received at the computer center the information thereon goes through several processes. First it is processed so that the information is transferred to one or more master tapes for that particular study kept at the computer center. Then the transient tape is stored and all future computation of data is performed on the master tape. The transient tape can be reused on the MIDCARS translator. At the time the information is transferred from the transient to the master tape a printoff is made which lists the file numbers, and identifying codes of all data previously put on the master tape, and then provides a straight printoff of the data on the latest transient tape. At a later stage data on the master tape are processed onto an intermediate tape on which the data are placed in different form from the master tape itself for ease and economy in later manipulation of data by the computer.

Probably the most time consuming step in the process of data reduction is programming. MIDCARS requires a computer with a large memory and great speed. The 6600 is currently the largest and fastest computer in the world. Even so it takes ten or fifteen minutes of printer time to print off the thousand or so pages of data from the three hundred or more hours of literal

EXHIBIT 5:

The Minnesota Interaction Data Coding and Reduction System (MIDCARS) (Cont'd)

observations themselves. So far there are operational three basic programs, and there will soon be more. These three programs provide: (1) A literal printoff of each observation; (2) edited printoffs classifying behavioral segments and sequences, placing each in a logical category, and numbering every sequence and segment, and classifying all logically impossible segments according to type; (3) counts of the frequencies of all legitimate categories or combinations of categories. A fourth basic program involving computation of duration is in preparation. This will provide numbers which describe the frequency of a particular category per a standard unit of time. Thus observations totaling different numbers of seconds may be compared.